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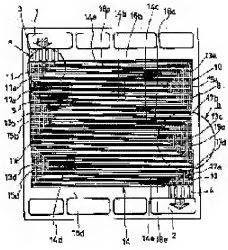
(54) SEPARATOR FOR FUEL CELL, AND FUEL CELL

(57)Abstract:
PROBLEM TO BE SOLVED: To reduce contact resistance to an electrode while eliminating staying gas and condensed water.
SOLUTION: In this separator, a gas flow groove 10 is formed of an inlet side flow groove part 11 positioned at an inlet 3 side, an outlet side flow groove part 12 positioned at an outlet 4 side, and an intermediate flow groove part 14 positioned between them. The intermediate flow groove part 14 is formed of separate flow groove parts 14a-14e respectively formed into a straight groove from one end to the other end and return groove parts 13a-13d returned at each end. The return groove parts 13a-13d are respectively formed into an intermittent groove, and a distance from a boundary between the return groove parts 13a-13d and the separate flow grooves 14a-14d to the flow groove ends 5, 6 is formed so as to be reduced as it separates far from boundary projecting parts 17a-17d provided between the separate flow grooves 14a-14d.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the separator for fuel cells, and a fuel cell.
[0002]
[Description of the Prior Art]In order to reduce atmospheric contamination as much as possible, the measure against exhaust gas of the car is important, and the electromobile is used as one of measures, but it has not resulted in spread on problems, such as a charging equipment and mileage.
[0003]A fuel cell is generated by the backward reaction of electrolysis using hydrogen and oxygen, does not have excretions other than water, and attracts attention as a clean power plant.
The car which uses said fuel cell is considered to be the most promising clean car.
In order that the solid polyelectrolyte type fuel cell may operate at low temperature also in said fuel cell, it is the most promising as an object for cars.
[0004]A solid polyelectrolyte type fuel cell is constituted by the cell cell which pinched the zygote joined with two gas diffusion electrodes on both sides of solid polyelectrolyte membrane with the separator. Fuel gas and oxidant gas are supplied to a fuel electrode and an oxidizing agent pole, respectively, and generate electricity according to electrochemical reaction. Said gas is supplied by the gas passageway provided in the separator. The rate of gas utilization is decided by how gas is uniformly supplied to the electrode surface of a gas diffusion electrode, and generation efficiency and output characteristics are influenced in it.
[0005]In said fuel electrode, when hydrogen in fuel gas contacts a fuel electrode catalyst, the following reaction arises.

[0006]$2H_2 \rightarrow 4H^+ + 4e^- H^+$ moves in the inside of an electrolyte, reaches an oxidizing agent pole catalyst, reacts to oxygen in oxidant gas, and becomes water.

[0007]In order that water may also move with movement of H^+ from a $4H^+ + 4e^- + O_2 \rightarrow 2H_2O$ fuel electrode, moisture is included in the fuel gas supplied to a fuel electrode, and it supplies. When an electrolyte is solid polyelectrolyte membrane, also in order to maintain electrolytic performance, the moisture more than a complement is included in the above-mentioned reaction, and fuel gas is supplied, and it is necessary to include moisture also in oxidant gas and to supply.
[0008]Moisture remains into fuel gas after being used for the electrode reaction. In oxidant gas, the moisture generated by an electrode reaction other than the moisture included at the time of supply is contained. A part of these moisture has a possibility of condensing and closing a gas passageway. If closed with water at a part of gas passageway, in order for the passage resistance of a gas passageway to go up and to make distribution of gas uneven, the power generation performance of a fuel cell falls.
[0009]As conventional technology, to JP,10-106594,A. The conduction slot which is a gas passageway is constituted from an entrance-side conduction slot, an outlet side conduction slot, and a middle conduction slot, This middle conduction slot is constituted from a one end side in the straight part which extends in the other end side, and the curved section turned up by each one end, and the separator for fuel cells with which this curved section and said entrance-side conduction slot, and said outlet side conduction slot are a lattice-like slot is indicated.
[0010]
[Problem(s) to be Solved by the Invention]Since the gas supplied since said entrance-side conduction slot had become a lattice-like slot can move freely, an electrode can be contacted quickly in time, gas diffusion nature can be improved and said outlet side conduction slot has become a lattice-like slot, the conventional

technology can prevent stagnation of water. Since gas flows uniform, and wastewater nature is improved and the rate of flow becomes quick by the straight part of said middle conduction slot, the conventional technology can improve gas utilization efficiency.

[0011]Since said curved section is a lattice-like slot, the conventional technology can reduce passage resistance, with the gas diffusion nature in this curved section maintained. Namely, improvement in gas diffusion nature and output performance is possible for conventional technology.

[0012]Moreover, although the steam in gas condenses conventional technology and it takes up a part of straight part of said middle conduction slot, since it can bypass gas in said curved section, gas can flow into the middle conduction slot of the downstream, and it can lessen influence of a **** ball.

[0013]However, the corner part which are two corners of the corner part which is a corner of said entrance-side conduction slot and said outlet side conduction slot, and the conduction Mizobata part of said curved section becomes a dead angle, and conventional technology has the problem that gas stagnates. When stagnating in said corner part which the steam in gas should condense, should become water and has become a dead angle of gas conduction, there is a problem that the state where it has stagnated continues, passage resistance becomes large, and distribution of gas becomes uneven.

[0014]Since said entrance-side conduction slot, said outlet side conduction slot, and said curved section are lattice-like slots, a touch area with an electrode is small and contact resistance is large, there is a problem that output performance becomes small.

[0015]Drawing 5 is a transverse-plane explanatory view near the curved section of the separator for fuel cells of conventional technology. 52a and 52b are straight parts which extend in the other end side from the one end side of a middle conduction slot. Said straight parts 52a and 52b are divided by the boundary heights 51. 50 is a curved section turned up when gas carries out conduction to said straight part 52b from said straight part 52a. This curved section is a lattice-like slot with the circular heights 50a.

[0016]When gas carries out conduction of said curved section 50, the portion near said straight parts 52a and 52b has the good conduction of gas, and a portion far from these straight parts 52a and 52b has the bad conduction of gas. There is a problem in which gas especially stagnates by the corner parts 50b and 50c. When the water of condensation comes to said corner parts 50b and 50c, it continues stagnating, passage resistance is enlarged and there is a problem which makes distribution of gas uneven.

[0017]In said curved section 50, although it is in contact with the electrode by said heights 50a, since the rate that the area of these heights 50a occupies to said curved section 50 is small, the contact resistance of an electrode and a separator becomes large. Although the rates that this contact resistance becomes large are few, making contact resistance small as much as possible, and raising output performance in the fuel cell with which many separators are laminated is called for.

[0018]It is what solved the aforementioned problem, and this invention does not have a dead angle to which gas and the water of condensation stagnate in said entrance-side conduction slot, said outlet side conduction slot, and said curved section, and distribution of gas is uniform, and contact resistance with an electrode provides the small separator for fuel cells, and it provides a fuel cell with high output performance.

[0019]

[Means for Solving the Problem]In order to solve the above-mentioned technical technical problem, technical means (the 1st technical means are called hereafter.) provided in claim 1 of this invention, In a separator for fuel cells of a couple with which a conduction slot which leads distributed gas which consists of fuel gas or oxidant gas to an outlet side from each entrance side was formed in a field of this electrolyte of a gas diffusion electrode of a couple which pinches an electrolyte, and this gas diffusion electrode of a couple facing in opposite directions, Said conduction slot of at least one of said separator for fuel cells, Consist of an entrance-side conduction slot located in this entrance side, an outlet side conduction slot located in this outlet side, and a middle conduction slot located among them, and this middle conduction slot, It consists of an independent conduction slot formed in the other end side from the one end side in a linear shape slot, and a clinch slot turned up by each one end, This clinch slot has the shape of a discontinuous quirk, and it is the separator for fuel cells being small as distance from a boundary between this clinch slot and said independent conduction slot to an end of said conduction slot separates from boundary heights provided between said independent conduction slots.

[0020]An effect by the 1st technical means of the above is as follows.

[0021]That is, since a corner part of said clinch slot can be eliminated and area of a straight part can be enlarged, gas in this clinch slot and stagnation of the water of condensation can be eliminated, and distribution of gas can be made uniform. A touch area with an electrode of said clinch slot can be enlarged, and contact

resistance can be made small.
[0022]In order to solve the above-mentioned technical technical problem, technical means (the 2nd technical means are called hereafter.) provided in claim 2 of this invention, Said entrance-side conduction slot has the shape of a discontinuous quirk, and it is the separator for fuel cells according to claim 1 being small as distance from a boundary between this entrance-side conduction slot and said independent conduction slot to an end of said conduction slot separates from an entrance.
[0023]An effect by the 2nd technical means of the above is as follows.
[0024]That is, since a corner part of said entrance-side conduction slot can be eliminated and area of a straight part can be enlarged like claim 1, gas in this entrance-side conduction slot and stagnation of the water of condensation can be eliminated, and distribution of gas can be made uniform. A touch area with an electrode of said entrance-side conduction slot can be enlarged, and contact resistance can be made small.
[0025]In order to solve the above-mentioned technical technical problem, technical means (the 3rd technical means are called hereafter.) provided in claim 3 of this invention, Said outlet side conduction slot has the shape of a discontinuous quirk, and it is the separator for fuel cells according to claim 1 being small as distance from a boundary between this outlet side conduction slot and said independent conduction slot to an end of said conduction slot separates from an exit.
[0026]An effect by the 3rd technical means of the above is as follows.
[0027]That is, since a corner part of said outlet side conduction slot can be eliminated and area of a straight part can be enlarged like claim 1, gas in this outlet side conduction slot and stagnation of the water of condensation can be eliminated, and distribution of gas can be made uniform. A touch area with an electrode of said outlet side conduction slot can be enlarged, and contact resistance can be made small.
[0028]In order to solve the above-mentioned technical technical problem, technical means (the 4th technical means are called hereafter.) provided in claim 4 of this invention are the separators for fuel cells given in claims 1 thru/or 3, wherein said shape of a discontinuous quirk is a lattice-like slot.
[0029]An effect by the 4th technical means of the above is as follows.
[0030]That is, since the shape of a quirk is simple, passage resistance can be made small and distribution of gas can be made uniform.
[0031]In order to solve the above-mentioned technical technical problem, technical means (the 5th technical means are called hereafter.) provided in claim 5 of this invention are the separators for fuel cells according to claim 4, wherein heights formed of said lattice-like slot are quadrangles.
[0032]An effect by the 5th technical means of the above is as follows.
[0033]That is, it has the effect that processing of said lattice-like slot is easy.
[0034]In order to solve the above-mentioned technical technical problem, technical means (the 6th technical means are called hereafter.) provided in claim 6 of this invention are the separators for fuel cells according to claim 4 with which heights formed of said lattice-like slot are characterized by a circular thing.
[0035]An effect by the 6th technical means of the above is as follows.
[0036]That is, since there is no angle in said heights and generating of a turbulent flow of gas can be made small, passage resistance can be made small and distribution of gas can be made uniform.
[0037]In order to solve the above-mentioned technical technical problem, technical means (the 7th technical means are called hereafter.) provided in claim 7 of this invention, An electrolyte. In a fuel cell which laminated many cell cells pinched with a separator for fuel cells of a couple with which a conduction slot which leads distributed gas which consists of fuel gas or oxidant gas to an outlet side from each entrance side was formed in a field of this electrolyte of a gas diffusion electrode of a couple to pinch, and this gas diffusion electrode of a couple facing in opposite directions, Said conduction slot of at least one of said separator for fuel cells, Consist of an entrance-side conduction slot located in this entrance side, an outlet side conduction slot located in this outlet side, and a middle conduction slot located among them, and this middle conduction slot, It consists of an independent conduction slot formed in the other end side from the one end side in a linear shape slot, and a clinch slot turned up by each one end, This clinch slot has the shape of a discontinuous quirk, and it is the fuel cell being small as distance from a boundary between this clinch slot and said independent conduction slot to an end of said conduction slot separates from boundary heights provided between said independent conduction slots.
[0038]An effect by the 7th technical means of the above is as follows.
[0039]Namely, by there not being gas in said clinch slot and stagnation of the water of condensation, distribution of gas is uniform, and since a small separator is used for contact resistance with an electrode of this clinch slot, a high fuel cell can do output performance.

[0040]
[Embodiment of the Invention]Hereafter, the example of this invention is described based on a drawing.
[0041]Drawing 1 is a front view of the separator of the solid polyelectrolyte type fuel cell for cars of the 1st example of this invention. Although said separator for fuel cells is metal, other materials may be sufficient if carbon etc. are a conductive material.
[0042]The gas inlet manifold 1 is formed in the upper bed part of said separator for fuel cells, and the gas outlet manifold 2 is formed in the lower end part. The conduction slot 10 which is a channel of the gas supplied to a gas diffusion electrode is established in the center section of said separator for fuel cells. Said conduction slot 10 was connected with said gas inlet manifold 1 via the entrance 3, and is connected with said gas outlet manifold 2 via the exit 4.
[0043]Said conduction slot 10 comprises the entrance-side conduction slot 11 located in the entrance 3 side, the outlet side conduction slot 12 located in the exit 4 side, and the middle conduction slot 14 located among them. This middle conduction slot 14 comprises one end in the independent conduction slots 14a-14e formed in the other end side in a linear shape slot, and the clinch slots 13a-13d turned up by each one end.
[0044]Said entrance-side conduction slot 11, the outlet side conduction slot 12, and the clinch slots 13a-13d are lattice-like slots which are one of the shape of a discontinuous quirk, and the heights 11a, 12a, 15a-15d formed in this lattice-like slot are circular heights. The linear shape heights 16a-16e are formed in said independent conduction slots 14a-14e. Said heights 11a, 12a, 15a-15d and 16a-16e contact a gas diffusion electrode, and the separator is also bearing the role which collects the electrical and electric equipment generated with this gas diffusion electrode.
[0045]In order to separate said independent conduction slots 14a-14e of each other, the boundary heights 17a-17d are formed. By these boundary heights 17a-17d, gas carries out conduction to an opposite direction in an adjoining independent conduction slot. Said clinch slots 13a-13d are bearing the clinch of the conduction to the opposite direction of this gas.
[0046]Drawing 2 is a transverse-plane explanatory view near [a] entrance-side conduction slot 11 of the separator of the solid polyelectrolyte type fuel cell for cars of the 1st example of this invention.
[0047]The distance from the boundary 31 between this entrance-side conduction slot 11 and the independent conduction slot 14a to the end 5 of the conduction slot 10 is small as it separates from the entrance 3. That is, the heights 16a of said independent conduction slot 14a are prolonged so that the end 5 of said conduction slot 10 may be approached, as they separate from the entrance 3. Said entrance-side conduction slot 11 has an approximately right triangle.
[0048]The gas supplied to said entrance-side conduction slot 11 through the entrance 3 from the gas inlet manifold 1 is supplied to said independent conduction slot 14a through a lattice-like slot. Since said independent conduction slot 14a has extended to about five end of said conduction slot 10 in the most distant place from the entrance of said entrance-side conduction slot 11, a corner part does not exist and gas and the water of condensation do not stagnate. Therefore, distribution of gas is uniform. Since the heights 16a of said independent conduction slot 14a are prolonged, a touch area with an electrode is large and contact resistance can be made small.
[0049]Similarly, since there is no corner part, gas and the water of condensation do not stagnate, but the outlet side conduction slot 12 also has uniform distribution of gas. Since the heights 16e of the independent conduction slot 14e are prolonged, contact resistance can be made small.
[0050]Drawing 3 is a transverse-plane explanatory view near [b] clinch slot 13c of the separator of the solid polyelectrolyte type fuel cell for cars of the 1st example of this invention.
[0051]The distance from the boundary 32 between this clinch slot 13c and the independent conduction slot 14c to the end 6 of the conduction slot 10 is small as it separates from the boundary heights 17c provided between the independent conduction slot 14c and the independent conduction slot 14d. That is, the independent conduction slots [14c and 14d] heights 16c and 16d are prolonged so that the end 6 of said conduction slot 10 may be approached, as they separate from said boundary heights 17c. Said clinch slot 13c has an approximately triangle.
[0052]The gas supplied to said clinch slot 13c is supplied to said independent conduction slot 14d through this clinch slot 13c lattice-like slot from said independent conduction slot 14c. Since said independent conduction slots 14c and 14d have extended to about five end of said conduction slot 10 in the most distant place from the boundary heights 17c of said clinch slot 13c, a corner part does not exist and gas and the water of condensation do not stagnate. Therefore, distribution of gas is uniform. Since the said independent conduction slots [14c and 14d] heights 16c and 16d are prolonged, a touch area with an electrode is large and contact

resistance can be made small.
[0053]Other clinch slots 13a, 13b, and 13d are the same.
[0054]Drawing 4 is a transverse-plane explanatory view near the clinch slot of the separator of the solid polyelectrolyte type fuel cell for cars of the 2nd example of this invention. The independent conduction slots 23 and 24 and the clinch slot 21 are established in the middle conduction slot of the conduction slot 20.
[0055]The distance from the boundary 33 between said independent conduction slots 23 and 24 and said clinch slot 21 to the end 7 of said conduction slot 20 is small as it separates from the boundary heights 25 provided between said independent conduction slot 23 and said independent conduction slot 24. That is, the heights 23a and 24a of the independent conduction slots 23 and 24 are prolonged so that the end 7 of said conduction slot 20 may be approached, as they separate from said boundary heights 25. Said clinch slot 21 has approximately semicircular shapes.
[0056]The gas supplied to said clinch slot 21 is supplied to said independent conduction slot 24 through this clinch slot 21 lattice-like slot from said independent conduction slot 23. Since said independent conduction slots 23 and 24 have extended to about seven end of said conduction slot 20 in the most distant place from the boundary heights 25 of said clinch slot 21, a corner part does not exist and water-of-condensation stagnation is not carried out [gas and]. Therefore, distribution of gas is uniform. Since the heights 23a and 24a of said independent conduction slots 23 and 24 are prolonged, a touch area with an electrode is large and contact resistance can be made small.
[0057]
[Effect of the Invention]As mentioned above, in the separator for fuel cells of a couple with which the conduction slot which leads the distributed gas which consists of fuel gas or oxidant gas to an outlet side from each entrance side was formed in the field of this electrolyte of the gas diffusion electrode of a couple in which this invention pinches an electrolyte, and this gas diffusion electrode of the couple facing in opposite directions, Said conduction slot of at least one of said separator for fuel cells, Consist of the entrance-side conduction slot located in this entrance side, an outlet side conduction slot located in this outlet side, and a middle conduction slot located among them, and this middle conduction slot, It consists of an independent conduction slot formed in the other end side from the one end side in a linear shape slot, and a clinch slot turned up by each one end, This clinch slot has the shape of a discontinuous quirk, and the distance from the boundary between this clinch slot and said independent conduction slot to the end of said conduction slot, Since it is the fuel cell which pinched the gas diffusion electrode which pinched the separator for fuel cells and electrolyte being small with the separator for fuel cells as it separates from the boundary heights provided between said independent conduction slots, The dead angle to which gas and the water of condensation stagnate in said entrance-side conduction slot, said outlet side conduction slot, and said curved section of the separator for fuel cells is lost, distribution of gas can be made uniform, and the thing with small contact resistance with an electrode to do can be performed, Output performance of a fuel cell can be made high.

[Translation done.]

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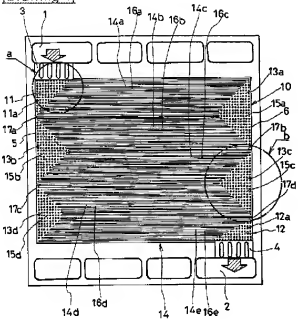
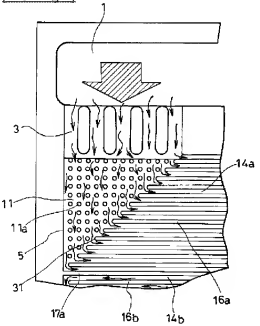
DRAWINGS

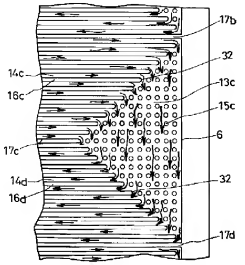
[Drawing 1]



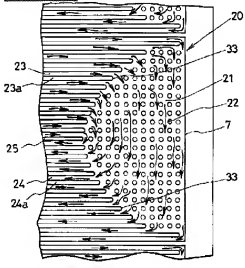
[Drawing 2]



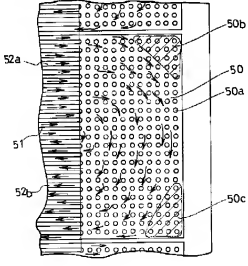
[Drawing 3]



[Drawing 4]



[Drawing 5]



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